AD NUMBER

AD-136 830

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HALSTEAD EXPLOITING CENTRE

REPORT ON WORK IN CONNECTION WITH IMPULSE PROPULSION.

PUBLICATION: BIOS / Gp. 2 HEC 1263 .

TRANSLATOR : Sgt. D. Redlich, W.A.A.F.

HTC/1263/1

Westfaelisch Anhaltische Sprengstoff-Actien-Gesellschaft,

CHEM. FABRIKEN

Works R e i n s d o r f

Report on work in connection with Impulse propulsion

Impulse Propulsion

On 3rd October 1940 the Research establishment of the Deutsche Waffen and Munitionsfabriken AG, Luebeck-Schlutup submitted a report made by Dr. L a n g w e i l e r , referring to a proposal to increase the ballistic effect by using directional combustion of the charge (Impulse propulsion). Following this, experimental manufacture of propellant charges was started by WASAG.

In order to make it possible to start on the first practical experiment proving the theory in Dr. Langweiler report, our aim was to try and make the charges without taking into account whether they would be suitable for manufacture and to use at first nitro cellulose powder. The material of 0-600 m/sec burning velocity at a pressure of 3000 atm required to make the Langweiler theory possible, is not available in the present position of science. In order to achieve an effect to take the place of such a high burning velocity, it was planned to construct charges of nitro cellulose with a surface enlarged accordingly.

Propellant grains with a very large number of channels were chosen and it was agreed that the grains should have a diameter of 20 mm and 331 perforations of 0.2 mm. This would make the wall between the channels about 0.75 mm thick. Besides the fact it is almost impossible to make a matrix with 331 channels on a circular surface with a diameter of 2 cm the arrangement of the channels in the explosive composition [illegible]

body could not be achieved. This point will be mentioned again later on. Therefore unfortunately the available installations, apparatus etc. proved unsuitable for manufacturing such propellants.

From several completed experiments for the manufacture of the propellant of question, so far only a purely hand-working method proved suitable. On principal the experiments were made only with completely dry tubular propellant with a diameter of about 0.95 mm and a channel diameter of 0.1 to 0.2 mm which were stuck together and made to propellant grain with the required dimensions.

The use of freshly pressed propellent tubes seems desirable, but proved not possible after the experiments were made. On compression of such propellant tubes, often perforations were squashed together, whilst hollows were formed when small pressure was used. It was also impossible to stick such tubes together and make one whole out of it, because the subsequent shrinking of such larger bodies causes a tension, which makes the joins tear apart.

Making of Multi-tubular grains

The dried tubular propellant sticks of 0.9 mm diameter are put in layers into the half of the cylindrically drilled shape which has a diamter of 22 mm after their surface has been covered with solvent so that the gaps are equalised using sufficient pressure (Illustration 1).

To check the regular geometrical make up of the grain tubes of different colours are used. Both halves of the shape filled with tubular sticks are then put together (Illustration 2) and united under pressure (Illustration 3) and one freed with the help of a vacuum at medium temperature from the adhering solvents within 8-10 days.

In order to control the uniform shrinking which occurs during the drying process and in order to compensate gradually the tension occurs after

further stretching appropriately dimensioned shapes are used. From the sticks produced in this way (Illustration 4) grains of 49.3 mm are cut out and lightly rubbed down to the required external diameter. Illustration 5 shows some of these grains.

The section of such a body (Illustration 6) shows the arrangement of the many channels. The longitudinal section of a propellant grain can be seen in illustration 7.

The grains made in this way were fired by the Research establishment of the DWM at Luebeck Schlutup, as there was at Reinsdorf neither a bomb nor a suitable barrel available at the time. A statement on the results achieved can be seen from a report by the DWM of the 1st March 1941 page 16. According to this it was found possible to keep the gas pressure of 0.4 - 0.5 ms approximately constant for at least a short time by using the multi tubular grain.

As is mentioned in the same report, the DWM made multi tubular grains also by hand methods using Reinsdorf "Polmasse" (Solventless Propellant) in tube and scroll form. The experiments were successful at least as regards burning even though the method of manufacturing the bodies might prove difficult.

The accuracy depends on the geometrical construction of the propellant which is the condition for their usefulness. Therefore it was the aim to eliminate the manual work and to use modern factory tools and methods. The maximum number of perforations in a grain pressed with the usual factory methods can amount to a circle with a diameter of approximately 9 mm with about 36 channels of 0.1 and 0.2 mm. Larger grains could either on the one hand not be freed within a short time sufficiently from the solvent or could not have the stresses eliminated. The making of the large multi tubular grains should therefore be [illegible]

as the nucleus body ("Kern korper"). These tubes are fixed after damping with solvent onto the already dry nucleus body. Illustr. 8 and 9 shows the finished nucleus body matrix in which the arrangement of the 36 drifts can be seen. In order to distribute the channels equally over the whole body, the construction of the nucleus and ring matrices is completed in accordance with the following 2 principles:

(a) The distribution of the channels is made on concentric part curves, the radicus of which is always a multiple of 1.8 mm. The number of channels arranged on the part curves can be calculated from the part circle circumference and the required thickness of the wall between 2 channels of 0.75 mm (Illustration 10).

(b) Honey comb pattern.

With the exception of those situated on the circumference, the centres of the channels are always at a distance of 0.95 mm from each other (ill. 11).

Ballistic Examination

To test such projectiles made experimentally, it would be desirable if a firing apparatus could be made available at Reinsdorf. It is planned that such propellants should be fired in a bomb.

Therefore suitable pressure bombs for pressures up to a maximum of 10.000 atm were ordered at Messrs. Peters, Berlin. With regard to the construction of these special bombs several conferences were held in conjunction with the DVM in Berlin at J. Peters. Originally it was suggested by the DVM that the automatic sealing device by Peters can not only be used for the bomb fastening ("Bombenverschluss") but also for the sealing of the "stamp-head" ("Stempelführung"). But since then experiments have

[illegible]

cylinder. The automatic sealing of the bomb fastening head ("Bombenverschlusskopfes") is to be constructed according to plans suggested by the D.M which makes a separate fuze electrode unnecessary as is also the case with the normal method of construction by Peters in which the Buna disc used acts as protection against hot explosive gases on account of the pressure piston adapted to a vacuum.

As the shooting range specially constructed for that purpose at Reinsdorf is expected to be completed shortly and the delivery of the bomb by Messrs. Peters is expected in the middle of May, the first bomb trials will take place in the near future.

Further questions.

Assuming the experiments with various multi-tubular grains are successful the following ques ions would arise:-

1. The technical manufacture of multi tubular grains out of a nitrocellulose substances with or without explosive oil.

2. Ballistic examination of these multi-tubular grains in the pressure bomb.

From the results obtained from these experiments the way to be taken for the further development is to be decided.

Appendix:

9 photographs (Illustration 1 - 9

2 drawings (Illustration 10 - 11).

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Zwischenräume ausgeglichen werden (Abb. 1).

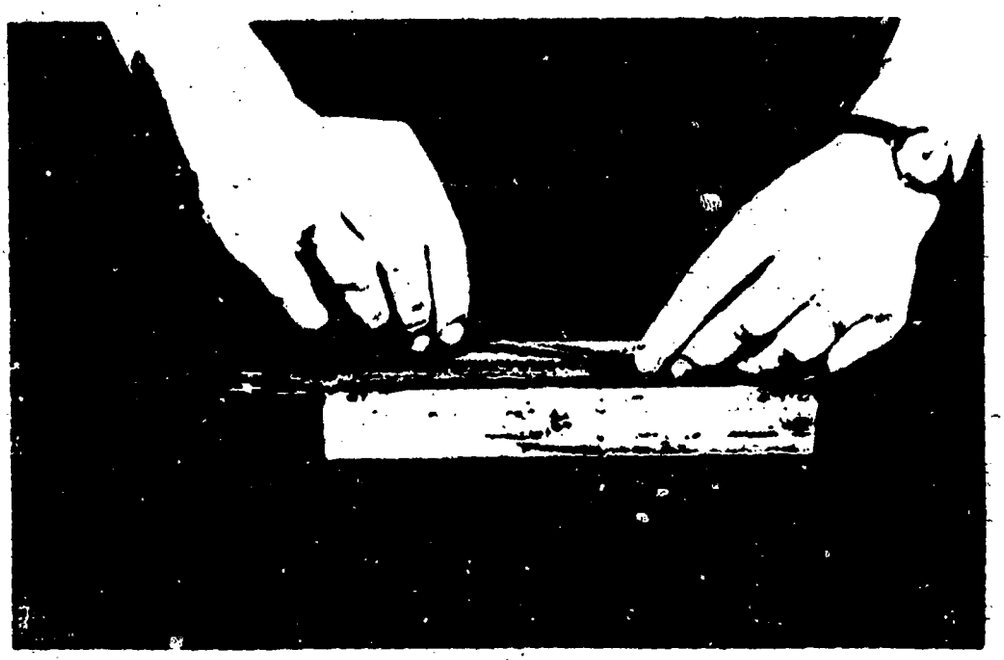

Abbildung 1.

[illegible]

[illegible] (Abb.2), [illegible] Druck [illegible] reinigt (Abb.3), und mittels

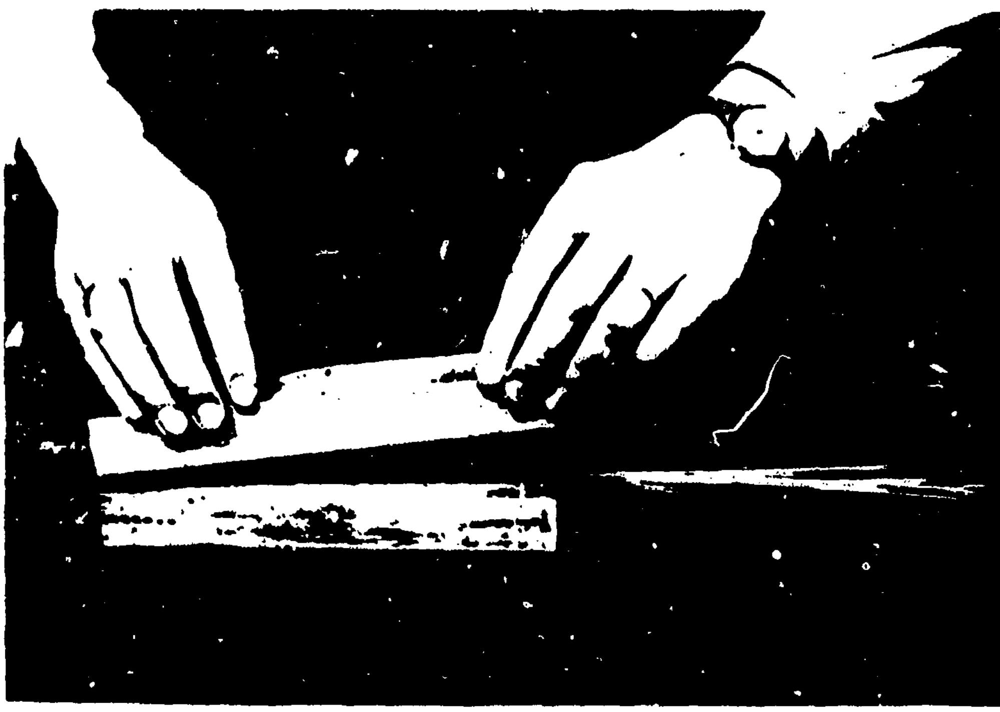

Abbildung 2.

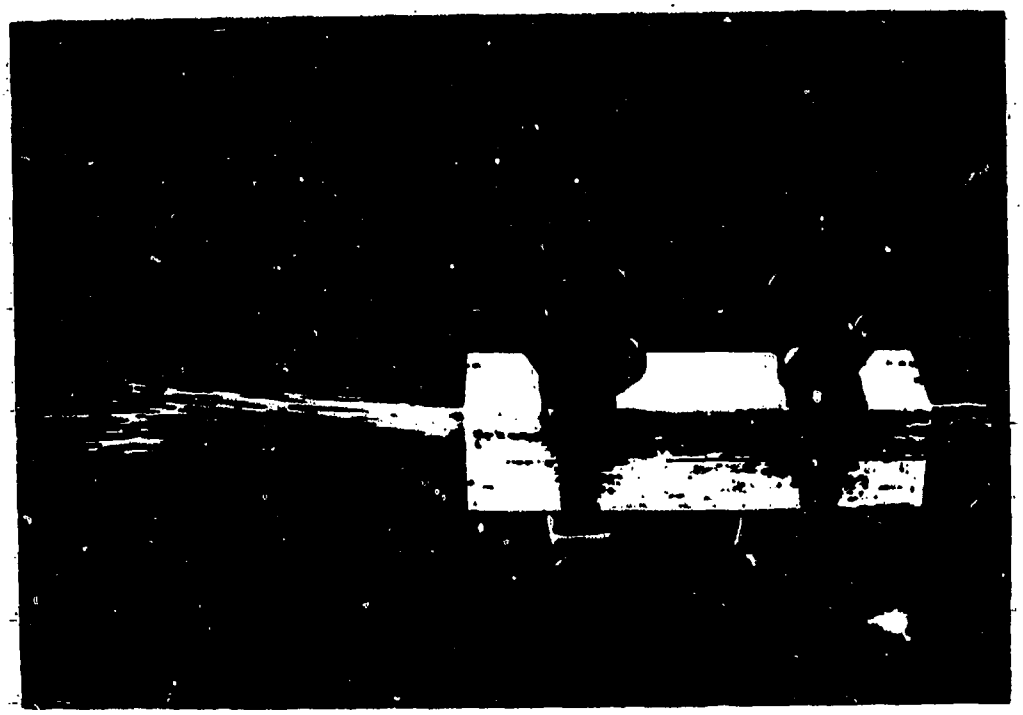

Abbildung 3.

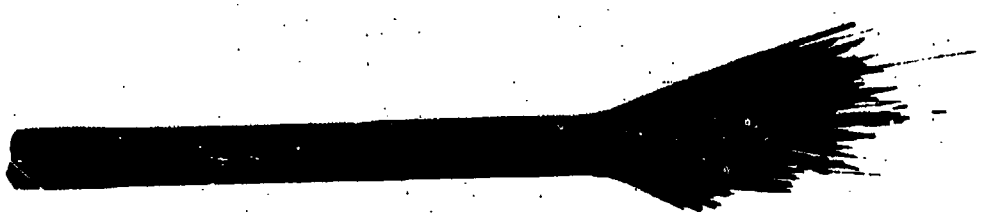

Abbildung 4.

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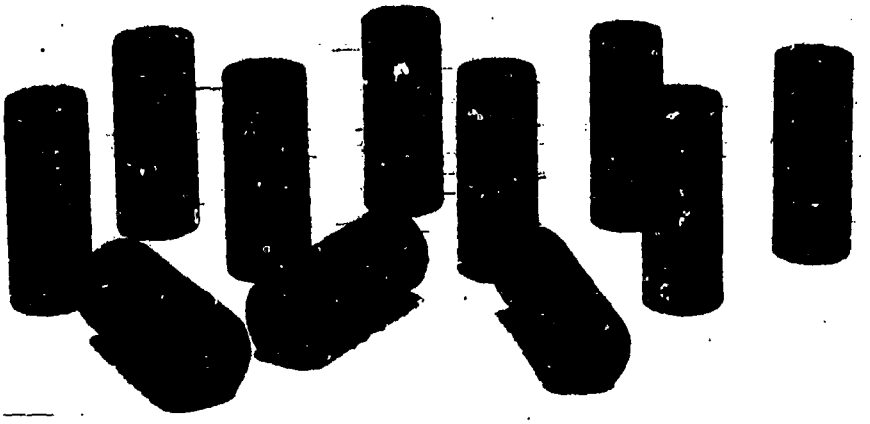


Der Querschnitt eines soliden Körpers (Abb.6) zeigt die Anordnung der Vielzahnes.

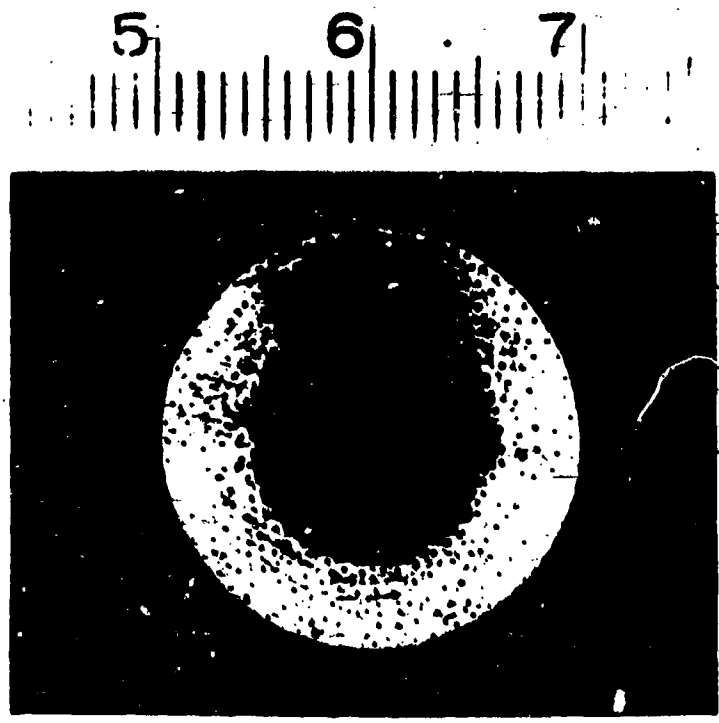
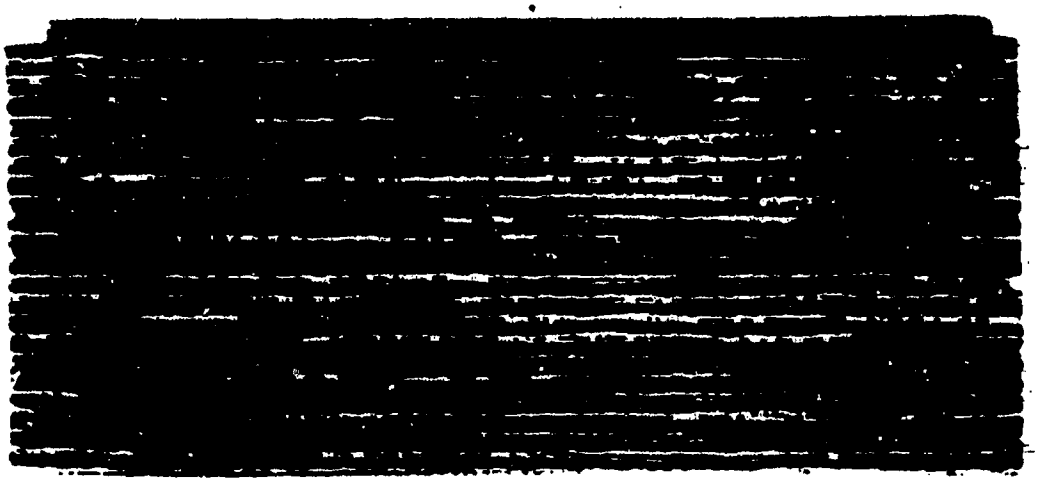


Abbildung 6.

Der Längsschnitt eines Pulverkörpers ist auf Abb.7 ersichtlich.-



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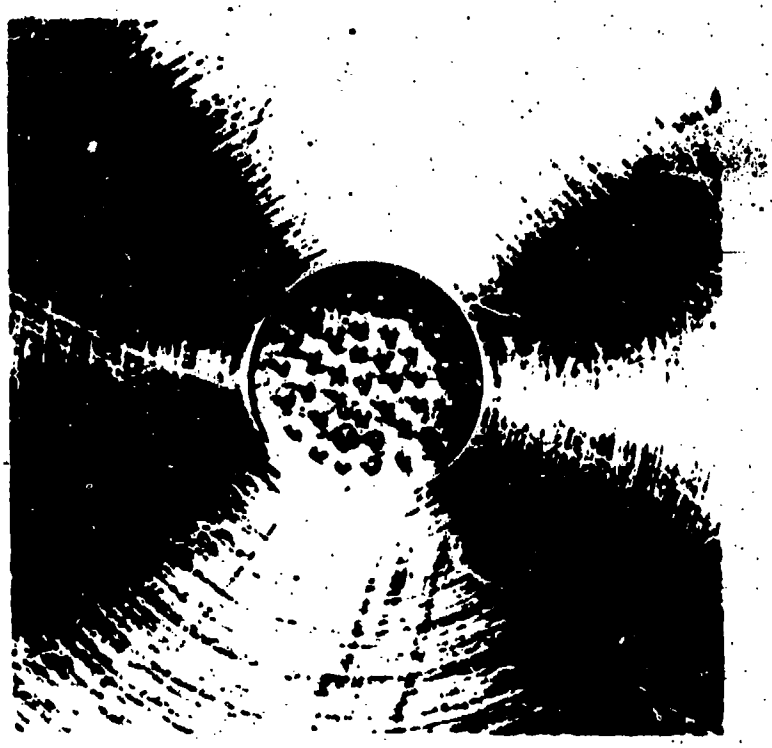

Abbildung 8.

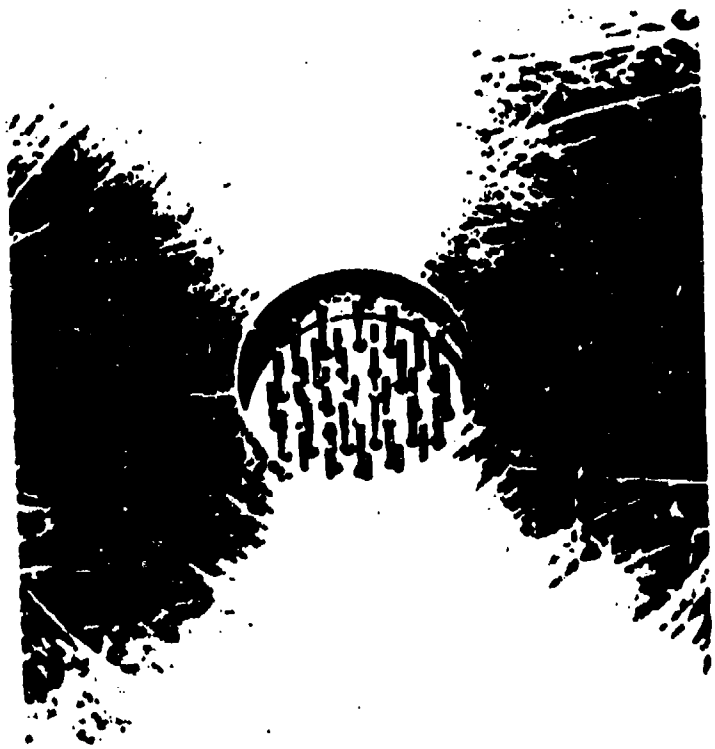

Abbildung 9.

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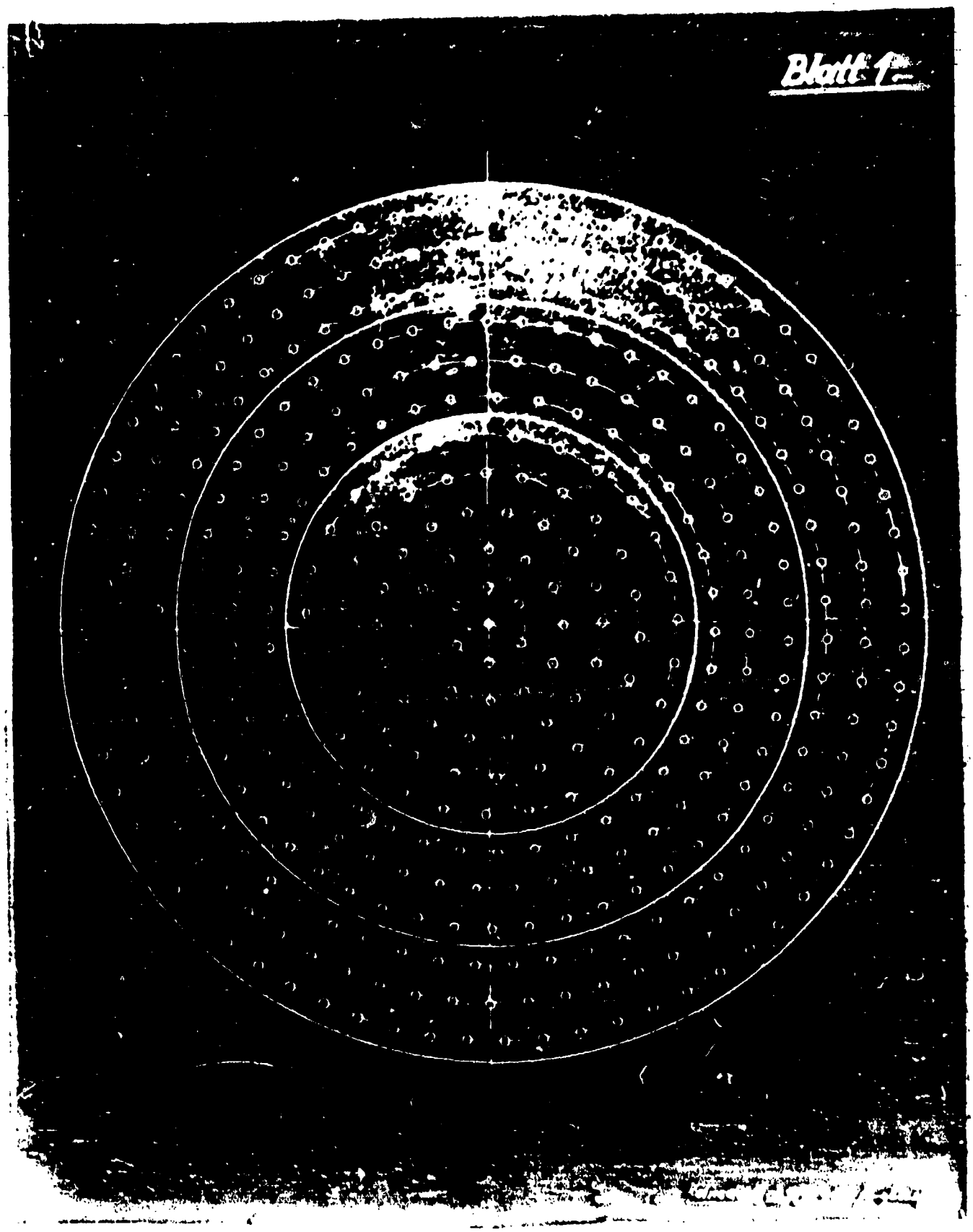

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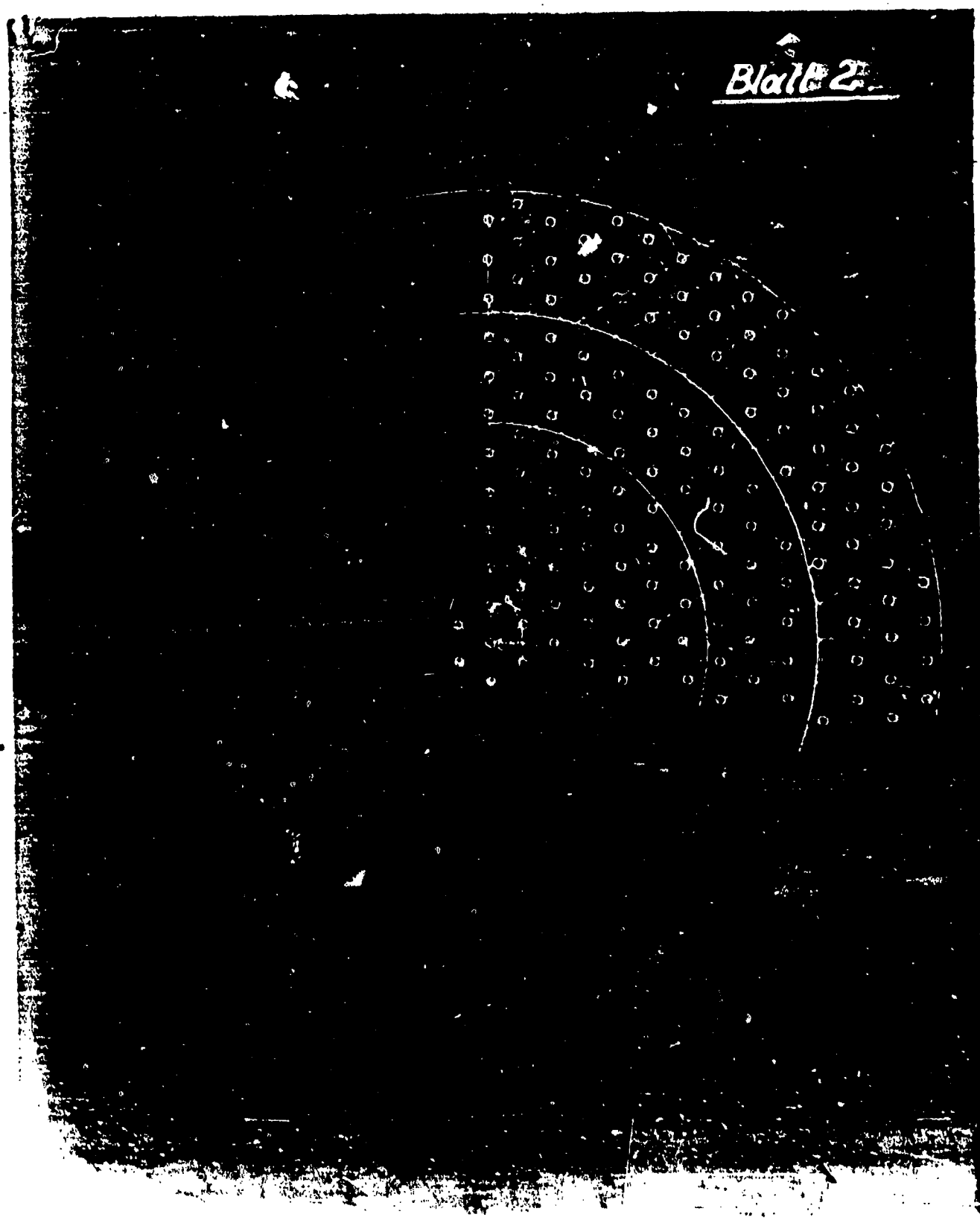

Received 2/8/00

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DIRECTORATE FOR FREEDOM OF INFORMATION AND SECURITY REVIEW
1155 DEFENSE PENTAGON
WASHINGTON, DC 20301-1155

12 JAN 2000

Ref: 98-M-0165/A1

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This refers to our letter to you dated October 7, 1999, regarding your appeal to the Information Security Oversight Office for 14 documents previously requested under Mandatory Declassification Review procedures. One document (AD346727) was provided to you by our letter dated November 19, 1999.

The review of 11 British documents you requested is complete and there are no objections to release. Titles of these documents are contained on the enclosed sheet and a copy of each is enclosed. We will advise you as soon as the reviews of the remaining two documents are completed.

Per DoD letter, Please mark these 11 documents "available to the public."

I verified the docs could be marked available for public release via telecon with Pat Skinner, DoD Security Review, 695-9556/6428 on 21 Jan 2000.

Kelly Akers
DTIC-RS

Sincerely,

SIGNED

H. J. McIntyre
Director

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Received 2/8/2000